TOSHIBA International Corp

GUIDE SPECIFICATIONS
THREE PHASE UNINTERRUPTIBLE POWER SYSTEM

TOSHIBA 4200***FA***

15 / 25 / 30 / 50 kVA

UPS GUIDE SPECIFICATIONS

4200*FA*-XT

(15 / 25 / 30 / 50 kVA)

1.0 SCOPE

1.1 System

This specification describes a continuous duty, three-phase, on-line, solid-state uninterruptible power supply system, hereafter referred to as the UPS.

2.0 SYSTEM DESCRIPTION

2.1 Applicable Standards

The UPS shall be designed in accordance with and be compliant with the following sections of the current revisions of the following standards:

ANSI C62.41 (IEEE 587) – Standard for Surge Withstandability
UL 1778 (CUL)
National Electrical Code (NFPA-70)
NEMA PE-1
OSHA
ASME
ISO 9001

2.2 Components

The UPS shall consist of the following components:

A. Converter

B. Chopper / Charger

C. Pulse-Width Modulated (PWM) Inverter

D. Static Switch Bypass

E. Microprocessor Controlled Logic and Control Panel

F. Input Circuit Breaker

G. Battery System

H. Input / Output EMI / RFI Filters

2.3 System Operation

The UPS shall operate as an on-line, fully automatic system in the following modes:

A. NORMAL - Incoming AC power is boosted using a chopper circuit, and converted into DC power. The DC power is then used to charge the battery bank while at the same time providing clean, DC power to the inverter circuitry. The inverter converts DC power to regulated AC power which feeds the load.

B. EMERGENCY - Upon failure of commercial AC power, the UPS shall derive power from the battery bank and continue feeding the load with clean, regulated AC power. There is no interruption to the critical load upon failure or restoration of commercial AC power.

C. RECHARGE - Upon restoration of the commercial AC source, the rectifier/chopper powers the inverter while simultaneously recharging the battery bank. The UPS shall have the following recharge process:

a) a constant level of current is used to recharge the batteries (the process shall utilize a current-limit function to prevent overcharging batteries, thus extending the life of the batteries)
b) as the batteries reach the normal charge level, a constant-voltage control shall begin which causes the battery recharge current to gradually decrease
c) under normal operation, the UPS battery bank "floats" at the 2.25-2.27 volts per cell DC level to stay fully charged and ready for the next discharge.

D. BYPASS MODE - Upon detection of an internal fault or output overload, the UPS shall automatically switch from inverter power to an internal bypass via the static switch. Transfer shall be within 4 milliseconds, causing no interruption to the critical load. While in bypass, the UPS shall protect against spikes and common/normal mode noise by utilizing a dual-winding output isolation transformer. “Return from Bypass mode” shall be an automatic function, without interruption to the critical load. Transfer to Bypass may also be performed as a manual operation via the UPS front panel.

E. POWER CONDITIONING MODE - Should the batteries be removed from the UPS, the UPS shall continue to function and still provide

protection against spikes, common/normal mode noise, load steps and frequency shifts (without battery back-up capability).

3.0 SYSTEM PARAMETERS

A. UPS Input

1) Input Voltage	208, 220, 240, 380, 480, 600VAC
2) Input Voltage Requirement	3 Phase, 3 -4 Wire + Ground
3) Voltage Variation	+10% to -30%
4) Rated Frequency	50/60 Hz
5) Frequency Range	45 - 65 Hz
6) Power Factor	> 0.98 lagging
7) Input Capacity	110% of UPS Output Capacity
8) Walk-In Function	From 20% to 100% over 5 seconds
9) Input Current Limit	125% of nominal capacity
10) Inrush Current	< 600% under synchronous condition
11) Input Current THD	< 3% Total Harmonic Distortion (THD)
12) Surge Withstandability	Meets ANSI C62.41 (IEEE 587)
13) Input Phase Rotation (Protection/Detection)	Standard front-panel alarm panel shall notify user that unit has been supplied with incorrect phase rotation on input to allow for correct installation. The UPS shall be fully protected to prevent damage from this event.

B. UPS Output

1) Rated Voltage	208, 220, 240, 380, 480, 600VAC
2) Output Voltage Requirements	3 Phase, 4 Wire and Ground
3) Output Capacity	15/25/30/50 kVA
4) Rated Load Power Factor	0.8 lagging
5) Voltage Regulation	+/- 2% nominal (balanced load) +/- 3% nominal (unbalanced load)
6) Voltage Adjust. Range	+/- 5% manually (by front panel user interface)
7) Phase Displacement	+/- 2 deg. (balanced load) +/- 4 deg. (100% unbalanced load)
8) Rated Frequency	50/60 Hz (jumper selectable)
9) Frequency Regulation	+/- 0.1% free running
10) Frequency Synch. Range	+/- 0.5/1.0/1.5 Hz (+/- 1.0 Hz Standard) User selectable
11) Frequency Slew Rate	1.0 Hz/second to 3.0 Hz/second
12) Voltage Transients	+/- 5% (100% step load change)

	+/- 3% (loss or return of input power) +/- 8% (bypass to inverter)
13) Transient Voltage Recovery	50ms maximum to within 2% of nominal
14) Overload Cap. (on inverter)	125% for 90 sec., 150% for 30 sec.
15) Overload Cap. (on bypass)	1000% for 10ms, 125% for 10 min.
16) Crest Factor	3.0
17) Harmonic Voltage Distortion	1.5% THD maximum, 1% maximum for any single harmonic (linear load)
18) Inrush Current Protection	Automatic transfer to bypass, then auto-return to inverter (retransfer may be inhibited by jumper)
19) Output Overcurrent	Hall-Effect Current Transformer and Fusing

C. Batteries

1) Battery Type: Sealed, Valve Regulated Lead Acid cells
2) Protection Time:

Each standard matching battery pack shall provide the minimum run-time:

- 21 minutes back-up time on 15 kVA
- 10 minutes back-up time on 25 kVA
- 13 minutes back-up time on 30 kVA
- 13 minutes back-up time on 50 kVA

3) DC Voltage Range:

UPS Capacity	15 -50kVA
Nominal Voltage	288 VDC
Alarms Voltage (Vlow)	252 VDC
Shutdown Voltage (Vmin)	216 VDC

4) Ripple Voltage: 2% RMS maximum

D. Environmental

1) Efficiency: 86% (AC/AC); 89-90% (DC/AC)
2) Operating Temperature: UPS: 32 to 104° F (0 to 40° C)
   Battery: 68 to 77° F (20 to 25° C)
3) Storage Temperature: UPS: -4 to 140° F (-20 to 60° C)
   Battery: prolonged storage above 104° F (40° C) causes rapid battery degradation
4) Relative Humidity: 30-90% (non-condensing)
5) Audible Noise: 60 dB ('A' scale @ 1 meter) – 15 / 25 kVA
   65 dB ('A' scale @ 1 meter) – 30 / 50 kVA

6) Altitude: 3300 ft. maximum without derating (up to 5000 ft.- 95% capacity; up to 7500 ft. - 90% capacity)

4.0 FUNCTIONAL DESCRIPTION

A. Converter / Charger / DC Chopper

DESCRIPTION - The converter/charger shall consist of a solid-state three phase rectifier, DC to DC converter (chopper), output filter, and transient suppresser network to regulate and maintain DC power to the inverter.

1) TRANSIENT SUPPRESSER - The incoming AC utility shall first be connected to a molded case circuit breaker as a means of disconnecting power to the UPS. Power shall flow through a surge absorber to prevent large transients from passing through to the load or damaging the batteries. Power shall then flow through a line filter to prevent sags or surges from passing to the load.

2) CONVERTER/CHARGER - The converter shall serve to change incoming AC power to DC, which shall be supplied to the DC chopper. From this point, DC power is used to recharge the battery bank while simultaneously providing power to the inverter.

a) Input Frequency Range: 45-65 Hz, continuous, without battery operation
b) Capacity: Battery recharge shall be to within 90% of nominal from a fully discharged state in 10 times the discharge time.

3) DC CHOPPER - The chopper circuit shall consist of inductors, capacitors, diodes and IGBT's (Insulated Gate Bipolar Transistors). The chopper shall have the function of providing start-up protection (by checking phase rotation of incoming utility power), boosting the DC to the inverter (during low AC input voltage conditions), providing power factor enhancement, and reducing reflected harmonics to incoming utility power.

B. Pulse Width Modulated (PWM) Inverter

DESCRIPTION - The PWM (Pulse Width Modulated) inverter shall incorporate an advanced IGBT design, an output isolation transformer, and output overcurrent protection for clean, regulated output power to the critical load.

1) INVERTER - The inverter network shall consist of a high speed IGBT switching network designed to supply non-linear loads with a clean and

steady voltage waveform. The inverter switching speed shall be fast enough to limit audible noise to 60 dBA at 3 feet (measured on 'A' scale).

2) *Optional* ISOLATION TRANSFORMER - The inverter network shall incorporate a shielded isolation transformer to provide complete isolation of the load from utility AC, as well as providing attenuation for high frequency noise common mode). Additionally, the transformer shall have a set of windings to condition the internal static bypass line.

3) OVERCURRENT PROTECTION - The output circuitry shall be equipped with a Hall Effect Current Transformer to detect and protect the inverter from excessively high currents.

C. Static Bypass Switch

1) TRANSFER - The static bypass switch shall consist of thyristor switches in conjunction with an output contactor to permit manual switching from bypass to UPS and UPS to bypass without power interruption. The UPS shall instantaneously transfer to bypass should a component fail during normal operation (provided the UPS and bypass are in synchronization). Auto-retransfer to UPS after an overload condition shall be completed within one second after the bus has dropped to 100% of nominal.

2) REMOTE RUN/STOP - A set of normally open dry contacts shall be provided to remotely transfer the UPS on-line and off-line. When the UPS is in this mode of operation, the UPS front control panel shall be disabled to provide a secured configuration.

D. Microprocessor Control System

1) DESCRIPTION - The UPS system shall be provided with a highly reliable microprocessor internal control system to perform start-up, transfers, monitoring, and battery recharging. The microprocessor shall provide important information to the user (via a liquid crystal display) with such as system status, fault messages and input and output parameters.

2) LED INDICATORS - The following LED indicators shall be provided on the UPS front panel displays, which mimic power flow through the UPS:

a) AC INPUT (Green Lamp) - Lights when normal AC input power is being supplied to the unit.
b) INVERTER (Green Lamp) - Lights when the UPS unit's inverter is normal.
c) BATTERY (Green Lamp) - Lights when the batteries are

discharging: flickers when the battery voltage is below minimum.

d) BYPASS (Green Lamp) - Lights when in circuit-bypass mode.

d) FAULT (Red Lamp) - Lights when a fault has been detected. See “System Diagnostics” for specific fault.

3) SYSTEM METERING - The UPS shall be provided with a single read-out display which displays, upon request, the following information:

AC INPUT VOLTAGE (Line to Line)
AC OUTPUT VOLTAGE (Line to Line, Line to Neutral)
AC OUTPUT CURRENT
BATTERY VOLTAGE
BATTERY CHARGING CURRENT
INPUT FREQUENCY
OUTPUT FREQUENCY
INPUT/ OUTPUT kW
POWER FACTOR

4) SYSTEM DIAGNOSTICS - The following diagnostic information shall be provided to troubleshoot the UPS should a fault occur:

UPS Ok
Memory Error
Wrong Phase Rotation of AC Input
Internal AC Circuit Fault
Internal DC Circuit Fault
Heatsink Overheat
DC unbalanced
DC Circuit Over/Under voltage
DC Circuit Overcurrent
Chopper Input Overcurrent
Inverter Overcurrent
Inverter Over/Under voltage
Inverter Overload
UPS Overload (including Bypass)
Inverter Output Current Limit
Low Battery Voltage
I/O not Synchronized
Auto-transfer Mode
Fuse Open
Battery Discharging Mode
UPS Output Disabled

5.0 MECHANICAL DESIGN

A. UPS Enclosure

The UPS shall be in a freestanding, NEMA1 enclosure equipped with casters and leveling feet. The overall dimensions and weights shall be as follows (without internal batteries):

UPS Size	Dimensions	Weight
15 kVA	20”W x 36.3”D x 59.8”H	794-998 lbs.
25 kVA	20”W x 36.3.”D x 59.8”H	804-1,003 lbs.
30 kVA	20”W x 36.3”D x 59.8”H	809-1,008 lbs.
50 kVA	35.25”W x 37.6”D x 59.8”H	1,221-1,946 lbs.

B. Matching Battery Enclosure

The battery cabinet shall consist of a freestanding, matching NEMA1 enclosure equipped with casters and leveling feet. The battery cabinet shall be provided with necessary hardware to mount cabinet adjacent to UPS cabinet (if desired). The maximum overall dimensions and weights shall be as follows:

UPS Size	Dimensions	Weight	Runtime
15 kVA	30”W x 295”D x 59.8”H	1,010 lbs.	21 Min
25 kVA	30”W x 295”D x 59.8”H	1,015 lbs.	10 Min
30 kVA	30”W x 295”D x 59.8”H	1,258 lbs.	13 Min
50 kVA	30”W x 295”D x 59.8”H	1,832 lbs.	13 Min

C. Cable Entry

The UPS shall be provided with cable entry from the rear of the UPS enclosure.

D. Ventilation and Maintenance Requirements

The UPS shall require the following minimum space for ventilation and maintenance: 6”(front), 6”(top), 28”(rear), and 20”(side).

6.0 STANDARD FEATURES

A. Emergency Power Off (EPO)

Emergency Power Off (EPO) terminals which trip open the UPS and battery circuit breakers.

B. RS232 Communication Interface

Serial data link will enable the UPS to interface with a computer to provide power status and diagnostic information.

C. IBM AS/400* interface

The following normally open dry contacts shall be provided through a DB9 male connector located on the rear of the UPS enclosure:

1) UPS On
2) Bypass Active
3) Input Power Loss
4) Battery Voltage Low

D. Battery Test Function

The UPS shall be provided with a “Battery Test” pushbutton to periodically check the condition of the batteries. Upon detection of a battery problem, the UPS shall notify the user of this condition allowing the user to perform a detailed check of the battery string.

*IBM and AS/400 are trademarks of International Business Machine Corporation.

7.0 SERVICE AND WARRANTY

A. Reliability

System mission reliability 200,000** hours and including bypass MTBF shall be in excess of 3,000,000** (Mean Time Between Failure) hours.

B. Maintainability

Calculated and demonstrated MTTR (Mean Time to Repair) shall be 45 minutes including time to diagnose the problem and replace subassembly.

C. Warranty

The UPS system shall be provided with a comprehensive three-year on-site warranty (**when purchased with a Factory-Authorized Start-up**). The warranty shall cover parts, labor, travel and freight for the UPS. The battery system has a full two year warranty with remaining years prorata. Typical on-site response time shall be 4 hours (24 hours maximum). The warranty period shall expire three years for UPS and two years for the battery system from date of shipment from manufacturer’s facility.

*Specification subject to change without notices.
**Times are accurate provided normal Preventative Maintenance procedures are followed.